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Overview of Sustainable Building Activities

Implementing the Governor's Sustainable Building Executive Order

Governor Davis issued Executive Order D-16-00 establishing the State's sustainable building goal:

To site, design, deconstruct, construct, renovate, operate, and maintain State buildings that are models of energy, water, and materials efficiency; while providing healthy, productive, and comfortable indoor environments and long-term benefits to Californians.

The Sustainable Building Task Force, comprised of representatives from various State departments with specific fiscal, construction, and environmental policy expertise, developed Building Better Buildings: A Blueprint for Sustainable State Facilities. This document recommends a course of action to achieve the Governor's goal. When implemented, this strategy will result in institutionalized changes to improve building performance throughout the state. The CIWMB plays a key role in supporting the Sustainable Building Task Force by providing resources and facilitating activities. Contact: Kathy Frevert, kfrevert@ciwmb.ca.gov, (916) 341-6476.

PROGRAMS AT THE CIWMB

Leadership in Energy and Environmental Design (LEED) Green Building Rating System

The U.S. Green Building Council (USGBC), the creator of LEED, was in the process of developing LEED Commercial Interior (CI), LEED Residential (R), and LEED Operations and Maintenance (O&M). Recently, the USGBC decided to merge these three individual rating systems into one, which will be known as LEED 3.0.

The CIWMB has been active in the development of LEED-R and LEED-CI and will continue to assist in the development of LEED 3.0. Additionally, the Sustainable Building Technical Group has developed a LEED supplement for California State facilities. Contact on LEED 3.0: Gregory Dick, gdick@ciwmb.ca.gov, (916) 341-6497. Contact on LEED supplement: Kathy Frevert, kfrevert@ciwmb.ca.gov, (916) 341-6476.

High Performance Schools Since 2000, staff from the CIWMB Sustainable Building program have participated in a group of government agencies, utilities, and nonprofit organizations recognized as the Collaborative for High Performance Schools (CHPS). In January 2001, CHPS completed the High Performance Schools Best Practices Manual to assist California school administrators, architects, and engineers in planning, designing, and building schools. These buildings are energy-efficient, resourceefficient, healthy, comfortable, and well-lit, and they contain the amenities needed for a quality education. The collaborative recently finalized a set of design criteria for schools to self-certify that they have achieved "high performance schools" status. To download a copy of the manual or for more information on the collaborative, visit the Web site: www.chps.net. **Contact:** Dana Papke, dpapke@ciwmb.ca.gov, (916) 341-6496.

State Agency Buy Recycled Campaign (SABRC)

CIWMB Buy Recycled program staff implement the mandated recycled-content product procurement laws of the Public Contract Code. State law requires all State agencies to buy recycled products in place of non-recycled products, to require their product suppliers to certify the recycled content of all products offered or sold to the State, and to track and report purchases annually. Staff also assists local government agencies and the private sector in establishing and improving "buy recycled" policies to successfully implement procedures that will

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assist with policy implementation and to track and report their successes. Concurrently, CIWMB staff is working with the Board and the Department of General Services to develop a multifaceted approach to increase acceptance and awareness of recycled-content products throughout all levels of State and local government. Contact: Kathy Marsh, kmarsh@ciwmb.ca.gov, (916) 341-6482.

Educate Landscaping Professionals

Staff is pursuing an aggressive outreach program and building partnerships with landscape architects and maintenance professionals. Landscapers who maintain residential, commercial, or public properties are learning to promote resource-efficient landscape design and maintenance practices. Landscape professionals are paying more attention to landscape design and management practices that reduce waste generation, reuse trimmings onsite, and recycle organic products (mulch and compost) back into urban landscapes.

Information on suppliers of urban compost and mulch and grasscycling techniques is currently available on the CIWMB's Organics Outlook Web page, www.ciwmb.ca.gov/Organics/. In addition, information on companies that supply recycled-content landscape products is also available through the CIWMB's recycled-content products database in the landscape and garden category. A series of fact

sheets and technical publications on resourceefficient landscape design and management guidelines are available at www.ciwmb.ca.gov/Organics /Landscaping. Staff is also working with landscape industry associations regarding the development of outreach programs, educational curriculum, and professional certifications regarding resource-efficient landscape design and maintenance practices. Contact: Ken Decio, kdecio@ciwmb.ca.gov, (916) 341-6586.

Services Provided By the Board

Recycled-Content Product Directory

CIWMB's recycled-content product directory is one of the largest of its kind on the Internet. The database lists more than 2,200 companies and 7,000 products, including construction and landscaping products. View the RCP directory at www.ciwmb.ca.gov/RCP/.

Contact: Linda Hennessy at rcp@ciwmb.ca.gov, (916) 341-6606.

Web site

The CIWMB Web site contains information about our Sustainable Building and Construction and Demolition Debris Recycling programs. Information on sustainable building basics, materials,

specifications, programs, and case studies can be reviewed at: www.ciwmb.ca.gov/Greenbuilding/.
Contact: Dana Papke, dpapke@ciwmb.ca.gov, (916) 341-6496.

A searchable database of construction and demolition waste processors and receivers and the recycled-content product database, *Debris Recyclers*Database, can be accessed at this address: www.ciwmb.ca.gov/
ConDemo/Recyclers/.

Contacts: Sabra Ambrose, sambrose@ciwmb.ca.gov, (916) 341-6499.

Sustainable Building Training Program

The CIWMB is currently developing a sustainable building design and construction curricula in order to conduct regional training seminars for State agencies and local governments. The curricula will include training modules to provide attendees with a basic understanding of sustainable design and construction, including:

- Cost vs. benefits of sustainable building.
- Designing projects for energy and water efficiency.
- Designing/building for waste prevention and recycling.
- Using recycled-content and sustainable/ renewable building materials.
- Designing, building, and operating buildings for

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- high standards of indoor air quality.
- Resource-conscious deconstruction and demolition practices.
- # Construction-site materials management.
- Sustainable operation and maintenance.
- # Case studies of green building performance, building materials, and building codes to help justify the adoption of new design and construction guidelines.

The first training seminars will be conducted in fall of 2001. Contact: Clark Williams, clarkw@ciwmb.ca.gov, (916) 341-6497.

Material Emission Testing

A \$130,000 contract for material emissions testing of portable classrooms and State construction was approved by the CIWMB to enhance markets for environmentally preferable recycled-content products. One of the major aspects of the study is that both virgin and recycledcontent products will be tested based on elevated material emissions sampling protocols that go beyond the standard manufacturer testing procedures. The ultimate goal of the project is to improve indoor environmental conditions in California classrooms and state facilities. Contact: Dana Papke, dpapke@ciwmb.ca.gov. (916) 341-6496.

Life Cycle Costing Study

The California Integrated Waste Management Board has joined with the State and Consumer Services Agency, the State Energy Resources Conservation and Development Commission, Air Resources Board, California Department of Transportation, Division of the State Architect, and the Department of Water Resources to develop a methodology for analyzing the cost-effectiveness of sustainable building strategies and features.

This study will be a key step in implementing Executive Order D-16-00 that requires the State to integrate sustainable building practices into its capital outlay design, construction, and operations processes. Unfortunately, like many other governmental and private builders, the State's current capital outlay process primarily focuses on the building's "first cost" without much regard to long-term operations and maintenance costs. Often, these long-term operations and maintenance costs have significant impacts on the State's budget. This study is anticipated to provide data supporting the contention that the use of lifecycle costing will achieve lower total costs throughout the life of the building. Contact: John Blue, jblue@ciwmb.ca.gov, (916) 341-6484.

FUNDING SOURCES

Sustainable Green Building **Grant Program**

The Sustainable Green Building Grant Program was designed to leverage and empower existing sustainable building efforts. It advances sustainable building practices in California by providing grants to government agencies to promote sustainable green building through program implementation, workshops, educational outreach, and construction. Current funding availability and grant information is available on the CIWMB Web site: http:// www.ciwmb.ca.gov /Greenbuilding/Grants/. Contact: Kristen McDonald, kmcdonal@ciwmb.ca.gov, (916) 341-6485.

Deconstruction Grant Program

The Deconstruction Grant Program funded two local government deconstruction projects, one with the city of San Francisco and the other with the city of Los Angeles. San Francisco's project will deconstruct four wood buildings on Treasure Island, while the project in Los Angeles will deconstruct approximately five libraries. Contact: Francisco Gutterres. fgutterr@ciwmb.ca.gov,

(916) 341-6493.



GREEN BUILDING BASICS

GREEN BUILDING BASICS

Buildings account for one-sixth of the world's fresh water withdrawals, one-quarter of its wood harvest, and two-fifths of its material and energy flows. Building "green" is an opportunity to use our resources efficiently while creating healthier buildings that improve human health, build a better environment, and provide cost savings.

What Makes a Building Green?

A green building is a structure that is designed, built, renovated, operated, or reused in an ecological and resource-efficient manner. Green buildings are designed to meet certain objectives such as protecting occupant health; improving employee productivity; using energy, water, and other resources more efficiently; and reducing the overall impact to the environment.

What Are the Economic Benefits of Green Buildings?

A green building may cost more up front, but it saves through lower operating costs over the life of the building. The green building approach applies a project life cycle cost analysis for determining the appropriate up-front expenditure. This analytical method calculates costs over the useful life of the asset.

These and other cost savings can only be fully realized when they are incorporated at the project's conceptual design phase with the assistance of an integrated team of professionals. The integrated systems approach ensures that the building is designed as one system rather than a collection of standalone systems. Some benefits, such as improving occupant health,

comfort, productivity, and reducing pollution and landfill waste are not easily quantified. Consequently, they are not adequately considered in cost analysis. For this reason, consider setting aside a small portion of the building budget to cover differential costs associated with less tangible green building benefits or to cover the cost of researching and analyzing green building options.

Even with a tight budget, many green building measures can be incorporated with minimal or zero increased up-front costs and they can yield enormous savings

What Are the Elements of Green Buildings?

Below is a sampling of green building practices.

Siting

Start by selecting a site well suited to take advantage of mass transit. Protect and retain existing landscaping and natural features. Select plants that have low water and pesticide needs and those that generate minimum plant trimmings. Use compost and mulches. This will save water and time. Recycled-content paving materials, furnishings, and mulches help close the recycling loop.

Energy Efficiency

Most buildings can reach energy efficiency levels far beyond California Title 24 standards, yet most only strive to meet the standard. It is reasonable to strive for 40 percent less energy than Title 24 standards. The following strategies contribute to this goal. Passive design strategies can

dramatically affect building energy performance. These measures include building shape and orientation, passive solar design, and the use of natural lighting.

Develop strategies to provide natural lighting. Studies have shown that it has a positive impact on productivity and well-being. Install high-efficiency lighting systems with advanced lighting controls. Include motion sensors tied to dimmable lighting controls. Task lighting reduces general overhead light levels.

Use a properly sized and energy-efficient heat/cooling system in conjunction with a thermally efficient building shell. Maximize light colors for roofing and wall finish materials, install high R-value wall and ceiling insulation; and use minimal glass on east and west exposures. Minimize the electric loads from lighting, equipment, and appliances.

Consider alternative energy sources such as photovoltaics and fuel cells that are now available in new products and applications. Renewable energy sources provide a great symbol of emerging technologies for the future. Computer modeling is an extremely useful tool in optimizing design of electrical and mechanical systems and the building shell.

Materials Efficiency

Select sustainable construction materials and products by evaluating several characteristics such as reused and recycled content, zero or low off-gassing of harmful air emissions, zero or low toxicity, sustainably harvested materials, and

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high recyclability, durability, longevity, and local production. Such products promote resource conservation and efficiency. Using recycled-content products also helps develop markets for recycled materials that are being diverted from California's landfills, as mandated by the IWMA.

Use dimensional planning and other material efficiency strategies. These strategies reduce the amount of building materials needed and cut construction costs. For example, design rooms on 4-foot multiples to conform to standard-sized wallboard and plywood sheets. Reuse and recycle construction and demolition materials.

Using inert demolition materials as a base course for a parking lot keeps materials out of landfills and costs less. Require plans for managing materials through deconstruction, demolition, and construction. Design with adequate space to facilitate recycling collection and to incorporate a solid waste management program that prevents waste generation.

Water Efficiency

Design for dual plumbing to use recycled water for toilet flushing or a gray water system that recovers rainwater or other nonpotable water for site irrigation. Minimize wastewater by using ultra low-flush toilets, low-flow shower heads, and other water conserving fixtures. Use recirculating systems for centralized hot water distribution. Install point-of-use hot water heating systems for more distant locations.

Use a water budget approach that schedules irrigation using the California Irrigation Management Information System data for landscaping. Meter the landscape separately from buildings. Use micro-irrigation (which excludes sprinklers and high-pressure sprayers) to supply water in nonturf areas. Use state-of-the-art irrigation controllers and self-closing nozzles on hoses.

OCCUPANT HEALTH AND SAFETY

Recent studies reveal that buildings with good overall environmental quality can reduce the rate of respiratory disease, allergy, asthma, and sick building symptoms. These buildings also can enhance worker performance. The potential financial benefits of improving indoor environments exceed costs by a factor of 8 and 14.

Choose construction materials and interior finish products with zero or low emissions to improve indoor air quality. Many building materials and cleaning/maintenance products emit toxic gases, such as volatile organic compounds (VOC) and formaldehyde. These gases can have a detrimental impact on occupants' health and productivity. Provide adequate ventilation and a highefficiency, in-duct filtration system. Heating and cooling systems that ensure adequate ventilation and proper filtration can have a dramatic and positive impact on indoor air quality.

Prevent indoor microbial contamination through selection of materials resistant to microbial growth, provide effective drainage from the roof and surrounding landscape, install adequate ventilation in bathrooms, allow proper drainage of air-conditioning coils, and design other building systems to control humidity.

BUILDING OPERATION AND MAINTENANCE

Green building measures cannot achieve their goals unless they work as intended. Building commissioning includes testing and adjusting the mechanical, electrical, and plumbing systems to ensure that all equipment meets design criteria. It also includes instructing the staff on the operation and maintenance of equipment.

Over time, building performance can be assured through measurement, adjustment, and upgrading. Proper maintenance ensures that a building continues to perform as designed and commissioned.

CITY OF SAN DIEGO'S RIDGEHAVEN GREEN BUILDING

At a glance, the Ridgehaven Building appears identical to its neighbor. In 1996, however, the 73,000-squarefoot Ridgehaven Building was completely renovated with many cost-effective sustainable performance methodologies and technologies. As a result, the Ridgehaven Building now uses 65 percent less total energy than its nearly identical neighbor, yielding a saving of more than \$70,000 in annual utility costs. This equates to \$1per square foot in annual savings. Even more important, the building occupants love its light and "healthy" atmosphere, boosting their productivity.

STEPS TO ENSURE SUCCESS

Establish a vision that embraces sustainable principles and an integrated design approach. Develop a clear statement of the project's vision, goals, design criteria, and priorities. Develop a project budget that covers green building measures. Allocate contingencies for

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additional research and analysis of specific options. Seek sponsorship or grant opportunities.

Seek the advice of a design professional with green building experience. Select a design and construction team that is committed to the project vision. Modify the RFQ/RFP selection process to ensure the contractors have appropriate qualifications to identify, select, and implement an integrated system of green building measures. Develop a project schedule that allows for systems testing and commissioning. Develop contract plans and specifications to ensure that the building design is at a suitable level of building performance. Create effective incentives and oversight.

Following are source materials used in preparing this article.

"Building Green on a Budget,"
Environmental Building News, Vol 8,
No. 5, May 1999,
www.ebuild.com/Archives
/Features/Low_Cost
/Low_Cost.html#General

William Fisk and Arthur Rosenfeld, Potential Nationwide Improvements in Productivity and Health From Better Indoor Environments, Lawrence Berkeley National Laboratory, May 1998.

D.M Roodman and N. Lenssen, "A Building Revolution: How Ecology and Health Concerns are Transforming Construction," Worldwatch Paper 124, Worldwatch Institute, Washington, D.C., March 1995, p. 5.

For More Information

California Integrated Waste
Management Board Green
Building Web site:
www.ciwmb.ca.gov
/GreenBuilding/. Includes the
manual "Designing With Vision:
A Technical Manual For Material
Choices In Sustainable
Construction" (Publication #43199-009).

"Green Building Basics," CIWMB Publication # 400-99-014. Hard copies of this and other CIWMB publications are available from the Publications Clearinghouse at 1-800-CA-WASTE inside California, or (916) 341-6306.

Other Web sites:
Department of Health Services,
Indoor Air Quality:
www.cal-iaq.org
U.S. Green Building Council:
www.usgbc.org
U.S. Department of Energy:
www.sustainable.doe.gov
/buildings/gbintro.shtml
Environmental Building News:
www.buildinggreen.com/

"The Sustainable Building Technical Manual" is available at www.sustainable.doe.gov /freshstart/articles/ptipub.htm.

"A Guide to Irrigation Water Needs of Landscape Plants in California" is available at www.dpla.water.ca.gov/urban/conservation/landscape/ wucols/



BUILDING CALIFORNIA'S SUSTAINABLE FUTURE:

A BLUEPRINT FOR STATE FACILITIES

"Building Better Buildings: A Blueprint for Sustainable State Facilities" responds to Executive Order D-16-00, which Governor Gray Davis issued to ensure that State buildings are designed, constructed, and maintained in a "sustainable" manner. The report was prepared by the Sustainable Building Task Force and reflects a unique collaborative effort of more than 32 government agency representatives. Their combined expertise in the fields of building, environment, and fiscal management produced the recommended action items presented in the blueprint.

By using less energy, water, and materials, sustainable buildings save California's natural resources and provide a healthier work environment. More natural light and cleaner air contributes to employee well-being and higher productivity. Sustainable buildings are also costeffective, saving taxpayer money by reducing operations and maintenance costs and lowering utility bills.

Quite simply, investing in appropriate sustainable features on the front end of construction pays off financially and operationally during the life of the building—often many times over.

The implementation of the blueprint recommendations should impact significantly how the State of California invests more than \$2.5 billion annually in construction funds. The State's infrastructure needs, estimated to exceed \$82 billion during the next ten years, will also be impacted.

The report is available for viewing at www.ciwmb.ca.gov/GreenBuilding/TaskForce/. For more information, contact Kathy Frevert at (916) 341-6476 or kfrevert@ciwmb.ca.gov.

GREEN BUILDING-EAST END OFFICE COMPLEX

CAPITOL AREA EAST END OFFICE COMPLEX

The East End Office Complex is a group of five office buildings being constructed in Sacramento, California, to house the Department of Health Services and the Department of Education. The State of California is using this project to showcase a variety of sustainable features and evaluate the results.

A number of innovative sustainable building strategies were considered for the East End Complex and a number were selected for different buildings so that a full range of options could be evaluated under working conditions for State office buildings.

CONSTRUCTION AND DEMOLITION WASTE PREVENTION

Before construction could begin on the site, a 1930s-era eight-unit apartment building on 15th Street between Capitol and N streets had to be removed. Rather than demolishing the structure, the State moved the building to a new location at 17th and N streets. This resulted in the diversion of significant material from the landfill and helped to preserve needed housing in the central city area.

Additionally, 60,000 cubic yards of soil excavated from the site was used for fill at two Home Depot locations under construction.

Another 104 tons of steel recovered from the demolition was reused as foundation rebar.

Waste prevention efforts extended beyond the structural phase of site preparation. Ten historic California Fan Palm trees, each approximately 60 feet tall, were removed from the site and replanted in Capitol Park. While the quantity of waste diverted (about 25 tons) was not significant, the historic and aesthetic value of these 80 year-old trees was.

Overall, the East End project has diverted 97 percent of on-site waste products from the landfill through recycling. This translates to more than a quarter of a million tons of diverted materials—more than is disposed by the City of Stockton in an entire year! While this type of diversion results in enormous disposal fee savings for the builder, it also significantly impacts the City of Sacramento's ability to meet its 50 percent waste diversion requirements under the IWMA.

ENERGY EFFICIENCY

The project was designed to exceed 1998 Title 24 energy efficiency standards by 30 percent. This will be achieved by a broad spectrum of strategies. These include: high efficiency windows and daylighting, highly efficient lighting and mechanical systems, and light-colored roofs.

DISTRIBUTED ENERGY GENERATION

At this time, a significant effort is underway to reduce the peak load requirements of State buildings. Part of the strategy is to incorporate distributed energy systems (that is, on-site power generation) into new building projects. Sacramento, with its sunny summers, is an ideal location for photovoltaic electrical generation. To take advantage of this reality, photovoltaic panels will

be used to shade vehicles on the parking structure roofs of Blocks 224 and 173. Additionally, photovoltaic panels were used as the exterior skin of the Block 225 mechanical penthouse.

Altogether, the 5,000 PV panels on this project will be capable of producing up to 200,000 kWh—providing enough electricity for 22 homes and reducing CO₂ emissions by approximately 200 tons per year.

RECYCLED CONTENT

From carpet (45 percent) to acoustical ceiling tiles (79 percent), many of the products used in the building met aggressive state requirements for recycled content. This includes not only the visible features such as signage and park furnishings, but also the hidden features, such as structural and reinforcing steel. Notably, in the Block 225 building, more than 27,000 cubic yards of concrete was used that contained between 25 and 40 percent fly ash. Not only does the inclusion of fly ash represent significant use of recycled content, it results in a significant increase in durability. Throughout the project, even while seeking high levels of recycled content, project managers strove to maintain high product performance, indoor air quality (IAQ) standards, and competitive pricing.

INDOOR AIR QUALITY

Low VOC PRODUCTS

Interior materials (including carpet, paint and other finishes) have been selected with an emphasis on reducing volatile organic compounds (VOCs) and dust. To ensure the accuracy of air quality claims made by vendors, products with testing data more than four or

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five years old were retested at an independent laboratory. In the pursuit of improved IAQ for this project, a new IAQ testing standard and protocol was developed and is now being used on projects throughout the state.

COMMISSIONING

Extensive pre-occupancy commissioning has been conducted during the construction phase of this project. Additional testing will continue, at a number of representative locations, after the building is occupied. Indoor VOC levels as well as the performance of mechanical systems (HVAC) will be assayed and adjusted accordingly to ensure a healthy indoor environment.

DUST CONTROL

Throughout the construction phase, preemptive measures were taken to reduce contamination of materials that might contribute to indoor air pollution. Higher efficiency air filters (85 percent above the standard) were specified to control particulates in the air supply during occupancy.

PRE- AND POST-OCCUPANCY FLUSHING

Prior to occupancy, but after the interior finishes have been applied, the building will be flushed with 100 percent outside air for a period of 30 days, 24 hours a day, at maximum airflow. After the furniture has been installed, the building will again be flushed with 100 percent outside air prior to occupancy.

KEEPING THE DIRT OUTSIDE

Recent studies have found that the bulk of dirt and dust found in commercial office buildings is brought in on the shoes of the building occupants. Compounding the seriousness of this pollution source is the potential toxicity of its components. Indoor dust commonly contains lead, asbestos, pesticides, volatile and non-volatile organic compounds, bacteria, mold, and a variety of allergens¹. To help mitigate this source of indoor pollution, the Block 225 building will have steel "track-off" grates at entryways to remove soil from the shoes entering the building.

MODULAR OFFICE FURNITURE

The offices of the Capitol Area East End Complex are likely to be the first to use the new State of California Modular Office Furniture Specifications. These specifications set new international industry standards for recycled content and indoor air quality. The specifications also require the implementation of environmentally preferable standards in the manufacturing process.

UNDERFLOOR AIR DISTRIBUTION

The Block 225 building will include more than a quarter of a million square feet of office space with an under floor air distribution (UFAD) system. The UFAD will provide enhanced ventilation, supplying conditioned air in the immediate vicinity of the occupants (rather than from the ceiling down). In this system the entire subfloor is pressurized, allowing greater individual control of ventilation in the cubicle work environment. The system also reduces future costs related to rerouting ventilation ducting as a result of reconfiguring office space. Additionally, the under floor space provides room for, and easier access to, information system cables and electrical supply. This reduces costs associated with making changes to these systems.

The State will be monitoring the performance of this building closely to evaluate the use of UFAD systems for future building projects.

WATER CONSERVATION

The project will also offer significant water savings and reduced sewage discharge through the use of water-efficient plumbing fixtures and flow restrictors. The project will also include water savings through the use of low flow (drip) and plant-segregated irrigation systems with advanced controls linked to environmental sensors.

The East End Office Complex is the most extensive sustainable building project ever constructed by the State of California. It is anticipated the lessons learned in this project will benefit future efforts in green building for years to come. For more information, contact John Blue of the CIWMB Sustainable Building Program at (916) 341-6484.

¹ Alex Wilson, Environmental Building News, October 2001

